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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is also included. (AG)

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FINAL REPORT

TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

MEDICAL TECHNOLOGIST (medical ser.) 0-50.01

B-420 or S-156

(Supersedes B-368)

TM 001 588

U. S. Employment Service in
Cooperation with
Colorado State Employment Service

U. S. DEPARTMENT OF LABOR
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STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY FOR MEDICAL TECHNOLOGIST 0-50.01

B-420

Summary

The General Aptitude Test Battery, B-1002A, was administered to a sample of 113 individuals employed at various hospitals, laboratories, and clinics in the State of Colorado. The criterion consisted of supervisory ratings made on a Descriptive Rating Scale. On the basis of mean scores, standard deviations, correlations with the criterion, job analysis, and their combined selective efficiency, Aptitudes G-Intelligence, V-Verbal Aptitude, P-Form Perception, and Q-Clerical Perception were selected for inclusion in the test norms.

GATB Norms for Medical Technologist 0-50.01 - B-420

Table I shows, for B-1001 and B-1002, the minimum acceptable score for each aptitude included in the test norms for Medical Technologist 0-50.01

TABLE I

Minimum Acceptable Scores on B-1001 and B-1002 for B-420

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
G	CB-1-H CB-1-I CB-1-J	115	G	Part 3 Part 4 Part 6	110
V	CB-1-J	110	V	Part 4	110
P	CB-1-A CB-1-L	110	P	Part 5 Part 7	105
Q	CB-1-B	110	Q	Part 1	110

Effectiveness of Norms

The data in Table IV indicate that 19 of the 37 poor workers, or 51 percent of them, did not achieve the minimum scores established as cutting scores on the recommended test norms. This shows that 51 percent of the poor workers would not have been hired if the recommended test norms had been used in the selection process. Moreover, 62 of the 80 workers who made qualifying test scores, or 78 percent, were good workers.

TECHNICAL REPORT

I. Problem

This study was conducted to determine the best combination of aptitudes and minimum scores to be used as norms on the General Aptitude Test Battery for the occupation of Medical Technologist 0-50.01.

II. Sample

The GATB, B-1002A, was administered to a sample of 113 individuals employed in various hospitals, laboratories, and clinics in the State of Colorado. The sample consisted of 56 Registered Medical Technologists and 57 Medical Technologist students working in the various hospitals, laboratories, and clinics. It was considered feasible to combine the two groups into one sample for the following reasons:

(1) Both groups were performing the same type of work.

(2) Their background training had, in both cases, been theoretical as well as practical.

(3) The only difference between the two groups was that the students had not as yet taken the examination to become registered.

The main requirement for employment of a Registered Medical Technologist is the fact that he or she is registered. For those technologists who are not registered, most of the hiring is based on references and recommendations. With the exception of Government installations, where a Civil Service Examination is required for eligibility, no tests are used in the selection of technologists for employment.

Table II shows the means, standard deviations, ranges, and Pearson product-moment correlations with the criterion for age and education.

TABLE II

Means (M), Standard Deviations (σ), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for Age and Education

Medical Technologist 0-50.01
N = 113

	M	σ	Range	r
Age (years)	24.2	4.4	17-39	.101
Education (years)	15.7	1.2	12-18	.292**

** Significant at the .01 level

The correlation between age and the criterion is not significant. The significant correlation between education and the criterion indicates that there is a tendency for the better educated technologists in the sample to receive higher ratings. Data on experience was not available.

III. Job Description

Job Title: Medical Technologist 0-50.01

Job Summary: Under general supervision performs a variety of standard serological, bacteriological, hematological and biochemical laboratory tests: Prepares tissue specimens and makes preliminary analyses; sterilizes equipment and apparatus; obtains laboratory specimens. Records laboratory test results and maintains files.

Work Performed: Performs various routine and special medical laboratory tests: Receives written order on a Laboratory Test Request Slip from supervisor. Determines, from information on Request Slip, the type of test, or tests, to be conducted. Uses such equipment and apparatus as beakers, tubes, mortars, burners, centrifuge, microscope, and slides. Prepares necessary equipment by connecting tubes or other pieces of equipment, placing in ice bath, sweeping containers with oxygen, hydrogen, or other gas, connecting vacuum hose, etc. Makes necessary adjustments to apparatus such as raising or lowering stands, turning on ovens, starting motors, etc. Accurately measures, using graduated cylinder or weights on an analytical balance, materials used in making such biochemical and microscopic analyses as blood tests, blood counts, urinalyses, Wasserman tests, bacterial tests, and other medical laboratory tests.

Prepares tissue specimens and makes preliminary analyses: Receives tissue specimen and order from supervisor. Ascertains from order, the type of test, or tests, to be made on tissue specimen in order to determine the particular technique to be used. Places specimen in small wooden mold and pours liquid parafine around tissue to prepare it for cutting. Removes waxed specimen from mold, places and adjusts it on cutting machine. Hand operates cutting machine to cut tissue into very thin slices. Places tissue slices in wire basket and dips them through various chemical solutions to stain specimen as required in analysis technique of the particular test to be conducted. Places stained tissue specimen on slide and inserts slide into position under microscope. Adjusts microscope to desired position and studies specimen and makes notes of finding. Submits notes to Pathologist for further study and for diagnostic purposes.

Maintains bottle file of tissue specimens by marking bottles containing specimens with index numbers and placing them in cabinet file. Marks tissue slides and tissue blocks with index number for filing and future reference purposes.

Sterilizes equipment and apparatus: Sterilizes equipment and apparatus by placing them in Autoclave; notes time and turns on steam valve; watches thermometer and controls inlet of steam to assure that the proper temperature is maintained; shuts off steam after prescribed length of time and removes sterilized objects from Autoclave, using care not to contaminate them on removal. Places equipment and appartus back in designated locations in readiness for future use.

Obtains specimens: Obtains laboratory specimens such as sputum, urine, pus, and blood from hospital wards, or directly from patient, using swabs, hypodermic needles, syringes, etc., and the prescribed laboratory techniques.

Records laboratory test results and maintains files: Posts laboratory test results on Individual Laboratory Record sheet and marks Laboratory Request Slip to indicate that posting has been completed. Posts from Laboratory Request Slip to Card File for Laboratory records and to Laboratory Charge Card so proper charges may be made to the individual patients. Files Laboratory Test Request Slip for future reference.

IV. Experimental Battery

All the tests of the GATB, B-1002A, were administered to the sample group.

V. Criterion

The criterion consisted of an average of the first and second line supervisors' ratings. These ratings were made on a Descriptive Rating Scale. The supervisors of the Pathological Laboratory in the hospitals and large clinics made the ratings. In the case of small clinics, the doctors employing the technologists made the ratings. The ratings were made on the basis of job performance. The basis for the assumption of comparability between the criterion ratings for the student technologists and the criterion ratings for the registered technologists is the fact that both groups were performing the same type of work. Their background training had, in both cases, been theoretical as well as practical. The only difference between the two groups was that the students had not taken the examination to become registered. A correlation coefficient of .92 was obtained between the first line and second line supervisors' ratings.

VI. Statistical and Qualitative Analyses

A. Statistical Analysis:

Table III shows the means, standard deviations, and Pearson product-moment correlations with the criterion for the aptitudes of the GATB. The means and standard deviations of the aptitudes are comparable to general working population norms with a mean of 100 and a standard deviation of 20.

TABLE III

Means (M), Standard Deviations (σ), and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB

Medical Technologist 0-50.01
N = 113

Aptitudes	M	σ	r
G-Intelligence	126.4#	12.9	.157
V-Verbal Aptitude	127.0#	15.9	.224*
N-Numerical Aptitude	122.2	11.9	.137
S-Spatial Aptitude	117.3	16.4	.016
P-Form Perception	125.6#	15.9	.122
Q-Clerical Perception	129.7#	18.0	.224*
K-Motor Coordination	122.4	17.9	.115
F-Finger Dexterity	113.9	18.5	.029
M-Manual Dexterity	117.0	19.3	.082

* Significant at the .05 level
\# Relatively high mean score

The highest mean scores in descending order of magnitude were obtained for Aptitudes Q, V, G, and P, respectively. All the aptitudes have standard deviations of less than 20. Aptitude N has the lowest standard deviation.

For a sample of 113 cases, correlations of .244 and .186 are significant at the .01 level and the .05 level of confidence, respectively. Aptitudes V and Q correlate significantly with the criterion at the .05 level.

B. Qualitative Analysis

The statistical results were interpreted in the light of the job analysis data. The job analysis indicated that the following aptitudes measured by the GATB appear to be important for this occupation.

Intelligence (G) - necessary to learn and master background information and to understand the underlying principles of medical technology.

Verbal Aptitude (V) - necessary for reading comprehension, understanding of lecture material and for facility of expression.

Numerical Aptitude (N) - required in pro-rating count findings, in calculating quantities and proportions, and in measuring specified quantities of standard solutions.

Form Perception (P) - required in measuring and in perceiving pertinent details of shape comparisons.

Clerical Perception (Q) - required in the careful differentiation of labels and in consulting reference materials to ensure the use of proper amounts.

C. Selection of Test Norms:

Based on the quantitative and qualitative evidence cited above, Aptitudes G, V, P, and Q warranted further consideration for inclusion in the test norms. The evidence for each of these aptitudes is indicated below.

Aptitude	High Mean Score	Significant Correlation with the Criterion	Importance Indicated by Qualitative Analysis
G	X		X
V	X	X	X
P	X		X
Q	X	X	X

Although Aptitude N appeared to be important on the basis of the job analysis data, it was not considered further for inclusion in the norms because there was not sufficient quantitative evidence of significance.

Various combinations of Aptitudes G, V, P, and Q, with appropriate cutting scores were selected as trial norms. The relationship between each set of trial norms and the criterion (dichotomized as indicated in section VII) was determined.

A comparison of the results showed that B-1002 norms consisting of G-110, V-110, P-105, and Q-110 had the best selective efficiency.

In test development studies an attempt is made to develop a set of norms such that the cutting score for each aptitude included in the norms will be set at a five-point score level close to one standard deviation below the aptitude mean of the experimental sample. Adjustments of cutting scores from one standard deviation below the mean are made to effect better selective efficiency of the norms. In this study the aptitude cutting scores are each within 5 points of one standard deviation below the aptitude mean of the sample.

VII. Concurrent Validity of Norms

For the purpose of computing the tetrachoric correlation coefficient between the test norms and the criterion and applying the Chi Square test, the criterion was dichotomized by placing approximately one-third of the sample in the low criterion group. This was accomplished by setting a criterion critical score of 30.5 which resulted in 37 of the 113 workers, or 33 percent of the sample, being placed in the low criterion group.

Table IV shows the relationship between test norms consisting of Aptitudes G, V, P, and Q with critical scores of 110, 110, 105, and 110, respectively, and the dichotomized criterion for Medical Technologist 0-50.01. Workers in the high criterion group have been designated as "good workers" and those in the low criterion group as "poor workers."

TABLE IV

Relationship between Test Norms Consisting of Aptitudes G, V, P, and Q with Critical Scores of 110, 110, 105, and 110, Respectively, and the Criterion for Medical Technologist 0-50.01

N = 113

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	14	62	76
Poor Workers	19	18	37
Total	33	80	113

$r_{tet} = .55$ $\quad$ $X^2 = 11.508$

$\sigma_{r_{tet}} = .16$ $\quad$ $P/2 < .0005$

The data in the above table indicate a significant relationship between the test norms and the criterion for the sample.

VIII. Conclusions

On the basis of mean scores, correlations with the criterion, job analysis data, and their combined selective efficiency, Aptitudes G, V, P, and Q with minimum scores of 110, 110, 105, and 110, respectively, are recommended as B-1002 norms for the occupation of Medical Technologist 0-50.01. The equivalent B-1001 norms consist of G-115, V-110, P-110, and Q-110.

The results of the Colorado study were compared with the following available studies on the occupation of Medical Technologist 0-50.01.

Sample	Company	Location
59 students	New York Community College	New York, New York
52 students	University of Minnesota	Minneapolis, Minnesota

An attempt was made to find a set of norms which would show good selective efficiency for two or more of the samples. However, this attempt was unsuccessful. The Colorado sample was used as the basis for the development of national norms for the occupation of Medical Technologost 0-50.01 for the following reasons:

1) It is the only available sample of people actually working as Medical Technologists;

2) It is the largest of the three available samples (N = 113) and includes more people than the other two samples combined (N of 59 + N of 52 = 111).

IX. Determination of Occupational Aptitude Pattern

When the specific test norms for an occupation includes four aptitudes, only those occupational aptitude patterns which include three of those four aptitudes with cutting scores that are within 10 points of the cutting scores established for the specific norms are considered for that occupation. Since none of the existing 23 occupational aptitude patterns meets these criteria for this study, the selective efficiency of any existing occupational aptitude pattern was not determined for this sample. However, the data for this sample will be considered for future groupings of occupations in the development of new occupational aptitude patterns.